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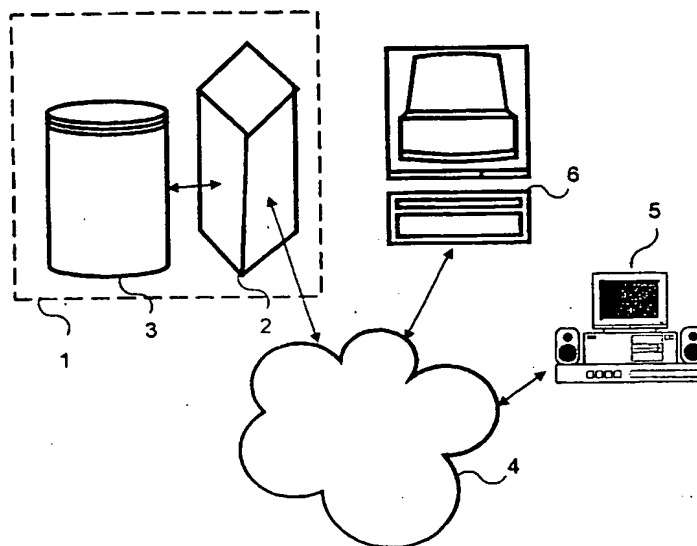
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(54) Title: METHOD AND APPARATUS FOR THE VISUALIZATION OF VRML SCENES



(57) Abstract: The invention relates to a computer pro-
cessing unit for VR (Virtual Reality) Art. At least
one first image model (CA) of a first two or three dimensional object is defined
having the same scale of orientation. The image models are defined,

product and a method for operating a general-purpose computer system
comprising an input unit, a storage unit, an output unit, a control unit and a
display unit. A first image model (CA) of a first two or three dimensional object is defined
in a co-ordinate system and mathematics in an ASCII text based VRML. The image models (CA)
are defined having the same scale of orientation. The image models are defined,
the first object in a co-ordinate system and mathematics in
the real positive or negative numbers, angle of rotation, and
displayed and controlled in a VRML enabled Web Browser.

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METHOD AND APPARATUS FOR THE VISUALIZATION OF VRML SCENES

TECHNICAL FIELD

5

The present invention is directed to a computer product for providing an image on a Web page and a method of handling a small interactive software platform in the Internet or an intranet Web page. The invention is particularly directed to a method of defining, creating, displaying, controlling and viewing the small
10 interactive software platform.

BACKGROUND

The World Wide Web (www), below called the Web, has grown explosively in
15 the recent time for the simple reason that its encyclopaedic content is reachable to everyone who has an access to a HTTP-compliant (HTTP = HyperText Transfer Protocol) protocol. With the Internet or an intranet connection from his/her computer station anywhere in the world at anytime.

20 Text, graphics, sound and/or video composed documents or files stored in a magnetic or optical storage device can be published to the Web in the Internet or intranet. As such, the published files can be viewed by millions of people everywhere in the world sequentially, randomly and simultaneously. It is to be noted that the number of Web Pages and Web Sites are increasing very fast and
25 that more than 243 countries are connected to the Internet.

A technical problem to be solved is to create an auto-run, re-scalable, 3D interactive software platform, which has a small file size and thus is easy to

create, display, control and view. However, a technical problem also to be solved is to provide a Web page to accommodate this interactive software platform so that it can produce as many as 16.7 million colour images of 3D objects. There is a desire of providing a computer software product and method
5 to generate an infinite number of designs and patterns of 3D and 2D objects in the following pages.

Conventionally, 3D objects are usually associated with huge file sizes having long down-load times and taking relatively long development times. A technical
10 problem is thus to provide small size files, which take only a short time to download.

OBJECTS OF THE INVENTION

15 An object of the invention is to provide multidimensional, in particular, 3D objects having small file sizes and hence short download times.

Another object of the invention is to provide a method to define a small interactive platform, which is pixel-free.

20

Still another object of the invention is to provide an interactive VR (VR = Virtual Reality) Art being able to be viewed from any display monitor ranging from a computer display, such as a screen or a projection, or from a mobile telephone display panel.

25

Yet another object of the invention is to provide a method of defining, creating, displaying and viewing a small interactive platform in a simple and economical way.

Still a further object of the invention is to provide a method of creating an interactive software platform prohibiting copying of the platform.

- 5 A particular object of the invention is to create, store, display, and view the world's smallest auto-run fully re-scalable interactive platform on the World Wide Web (www) enabled dynamically reconfigurable pixel free 16.7 million colour three-dimensional (3D) Virtual Reality (VR) art.

10 THE INVENTION

The technical solution to the problem and the objects is to provide an ASCII text based HTML (HyperText Markup Language) and/or VRML (VRML = Virtual Reality Modelling Language) file, which can be viewed from HTTP-compliant
15 Web and/or a VRML enabled Browser on the Web. The document or file is created in a co-ordinate system (thus vector, line or surface based instead of pixel based) making it free from pixel dependency.

- Thus, a computer program product for providing an image on a Web page is
20 provided according to the invention. This computer program product comprises:
- VRML code, which when run on a computer with a display unit causes the computer to generate at least one first image of a first model;
 - VRML code, which when run on a computer with a display unit causes the computer to generate at least one second image of a second model;
 - 25 □ VRML code, which when run on a computer with a display unit causes the computer to move the first model in relation to the second model both around common points (CP) such that the first and second models are mutually movable and rotational with respect to said common points (CP) and thus are

united to be seen as one image of a united object comprising the first and second models at anytime. The common points could be just one common point, but they could also be a straight line, or one side of the surface model, i.e. comprise a large number of points;

- 5 □ the first and second models being created in Cartesian co-ordinates and their respective angle of rotation being specified in radians.

The VRML codes for said first and second models are preferably provided in an ASCII text based VRML. Each of the models could be either a 2D or a 3D
10 model, the united object comprising the first and second models movable around the common point has one of the following combinations: two 3D images, two 2D images, and one 2D and one 3D image.

The invention also relates to a method in a computer system comprising a client
15 computer (client) and a server computer (server). The client computer is connectable to a server computer via a network, such as the Internet, for enabling the down loading of a complex image in a time efficient manner using a limited bandwidth. The method comprises the steps of:

- addressing a Web page provided by the server computer or client computer;
- 20 □ downloading a computer program file of the kind mentioned above.

The invention also relates to a method for operating a general-purpose computer system connected to the Internet or an intranet and comprising a display unit, an input unit, a memory unit, an output unit and a processing unit for plural types
25 of VR (Virtual Reality) Art. The method comprising the following steps:

- defining at least one first image of a first two or three dimensional model in a co-ordinate system and mathematics in an ASCII text based VRML;

- defining at least one second image of a second two or three dimensional model having the same or smaller size than the first model in a co-ordinate system and mathematics in the ASCII text based VRML;
- the models being specified in real positive or negative numbers, angle of rotation, and scale of orientation;
- uniting at least first and the second models into a united image object in relation to a common point (CP);
- providing at least the united image object in a VRML enabled Web Browser.

10 For the present invention, a VRML file is used to create VR Art. This is a novel use of VRML commands. Particularly, the art object could be defined in a co-ordinate system and mathematics in an ASCII text based VRML. The VR art is created and generated by a Cartesian Co-ordinate system and mathematics for VRML such that the VR Art is in a dynamic arrangement that generated
15 movements and instantaneous formation of an infinite number of combinations and permutations of design and patterns.

Also, this implicates that it does not matter where the models are placed on the screen or screens, and what the size and colour etc are for the model when
20 created. This is achieved when a micron-size movement of a pointing device has been triggered. All this is done without modifying any single ASCII character in a loaded source code of the created three dimensional object at any instance.

When a client is connected to an Internet Access Service Provider (IASP) or
25 makes a TCP/IP request to a server, that utilises a HTTP, it is a HTML- or VRML-compliant client. By means of an easily available HTTP-compliant WWW, VRML enabled Browser, the client can gain access to display all such files. The server has a certain time period to return the accessed file to the client

from the server, depending on the size of the file and the Internet traffic at the time of access.

As mentioned above, the invention is particularly directed to a small auto-
5 running VR Art, called e-Motion, which comprises a plurality of colours, up to a maximum of 16.7 million colours. The invention is running independent World Wide Web (WWW) enabled dynamically re-configurable pixel-free VR Art. It can generate a piece of art, which is created and generated by only the Cartesian co-ordinate system and mathematics for VRML . More particularly it is directed
10 to the notion and methods of specifying and using the ASCII text based code in VRML file, albeit without any graphic file embodiment. Any genre of markup language such as HTML and/or VRML file, albeit with different file attributes and properties, is referred to as a Web page. A collection of Web pages is referred to as a Web Site.

15

A Web page can also be created, stored and viewed by any individual as long as there is a HTTP-compliant VRML-enabled Web Browser capabilities installed on a computer or a portable computer or hand held device.

20 ADVANTAGES

An interactive software platform is provided with 3D image models having a small file size, quick in downloading time, and being easily accessible to anyone who has an HTTP-compliant VRML enabled Web Browser.

25

Another advantage with the invention is that it reinforces and enforces prohibition from copying and downloading by any Web-crawler or meta-Web-crawler to grab and crawl any HTML or VRML file which, generally, has been

regarded as permissible copiable text and indexes, but never copyright protected art.

Still another advantage is that the VR Art on the Web can be viewed from a display without the need of acquiring, i.e. this VR Art on the Web is generated without the need and use of a 3D modelling tool to scan, edit, display, store, and view a colourful (comprising as much as 16.7 million colours) 3D art. It also eliminates the need of using the texture mapping feature available in most, if not all, of the prior known 3D modelling software. A VRML file can be created and edited using any plain text editor.

It is also an advantage to allow any local or distant viewer to communicate with the colourful VR art interactively and freely, without the need to click and touch the VR artwork. By varying the speed and/or direction of the interactivities between the viewer and the artwork, it determines and generates the infinite number of combinations and permutations of unique design, pattern and colour generated on every face of the artwork concurrently and instantaneously.

A further advantage of using a VRML file system in the creation, displaying and retrieval of the generated Art is that it is capable of generating simultaneous movements and instantaneous formation of an infinite number of combinations and permutations of the model design and of its patterns on each of its surfaces, even when a micron-size movement on a pointing device is triggered on the screen. The formation of an infinite number of designs, patterns, and movements are all accomplished without modifying the code.

A conventionally colourful 3D pixel based graphic file defining an image model takes much longer time to be accessed as compared to the same image when

defined as an ASCII text file, such as with the present invention, due to the fact that such a graphic file will be much larger. The resolution of such a graphic file will also depend on different features, such as:

- how the graphic image was originally composed,
- 5 • the display technology,
- the configuration of the monitor or display device used, the "re-sampled file" of the image model when transmitted and viewed on the viewer's display device with the viewer's configuration and settings of the display device.

10 As conventional in the art, VRML files are used for architectural building, walk-or fly-throughs, furniture and interior design, engineering design and simulation. They could also be used for medical sciences, VR modelling as well a 3D single user or multi-user standalone or networked games to be viewed on VRML enabled Browsers or game and/or play stations. It is also used for creating
15 avatars or Worlds for Worlds enabled Browsers.

The novel use according to the invention for defining 3D objects in relation to the known existing methods to create VR Art is by far the most economical method of generating VR Art in terms of file size, creation and development
20 time, as well as downloading time either from a local or remote HTTP-compliant Web server.

Using VRML commands and presenting the VR Art on the Web makes the VR Art easy to maintain, in storage space, portability, viewing platforms and
25 reachable audience size.

The file created in accordance with the invention can be defined, created and displayed, with or without plug-ins, on a standard computer connected to the

Internet or an intranet. It could also be a computer connected to a network of any portable computer, hand-held devices, or any third generation (3G) Wireless Application Protocol (WAP), or WAP-compliant wireless applications including mobile telephone with or without Internet Access. Such a Web page can be
5 linked to as many Web pages and Web sites as available on its link references and its respective activation.

BRIEF DESCRIPTION OF THE DRAWINGS

- 10 For a more complete understanding of the present invention and for further objects and advantages thereof, reference is now made to the following description of examples of embodiments thereof - as shown in the accompanying drawings, in which:
- 15 FIG. 1 illustrates an embodiment of elements connected to the network Internet to provide the invention;
- FIG. 2 illustrates the steps of creation of a VR Art in a computer in accordance with the invention;
- FIG. 3 illustrates a united VR Art in accordance with the invention; and
- 20 FIGs 4 to 10 illustrate different variations of created VR Art, in grayscale, as seen in a Browser in a Web page;

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

- 25 The environment of the program product according to the invention will enable the creation and provide access to VR Art (Virtual Reality Art) and build a Sculpture Park on the Web with or without TCP/IP connection. It can export to or convert the VRML source file into a file format suitable for use of file creation in

a three-dimensional (3D) modelling tool or software or Java Applets or any intelligent pointing device. It can output to any two- or three-dimensional printer from any computer system to an HTTP-compliant protocol VRML enabled Browser to a WAP-compliant mobile telephone display screen. All variations of this type of Art are considered within the scope of the invention, regardless of the kind of display the image is displayed on. The display could be a monitor screen or a projection screen or the like. The invented united object can even be fabricated as a solid model in the real world space.

FIG 1 illustrates some necessary elements for creating the VR Art. As convenient a server 1, comprising of a computer 2 and a storage 3, is connected to a network 4, such as the Internet or an intranet or the like. A computer device 5, for example of multimedia kind, on which the VR Art is created, is also connected to the network 4. A number of computer devices 6 of different kinds are also connected to the network 4. The VR Art provided on the network 4 by the computer device 5 can be viewed from the computer devices 6.

SUMMARY OF STEPS OF CREATION (FIG 2)

For ease of understanding the structure in FIG 3 is first set out below.

Image Model CA = outer cube ABCGHE

Image Model CB = inner cube PQRVWT

United image object is CA & CB with CP as control point

25

Image Model CA has the following surfaces:

BCGF = 10A (Front)

ADHE = 10B (Back)

ABCD = 10C (Left)

FGHE = 10D (Right)

5 ABFE = 10E (Top)

DCGH = 10F (Bottom)

Image model CB has the following surfaces:

QRVU = 11A (Front)

10 PSWT = 11B (Back)

PQRS = 11C (Left)

TUVW = 11D (Right)

15 PQUT = 11E (Top)

SRVW = 11F (Bottom)

A VR Art is created at the computer device 5, as illustrated in FIG 2, in the following way:

20

1a Define two image models of 2D or 3D objects, below called 2D or 3D image models, in the form of vectors and angular relations between the vectors.

FIG 3 shows two 3D image models, i.e. CA, having the surfaces 10A to 10F, and CB, having the surfaces 11A to 11F. Each surface 10A to 10F and 11A to 11F of the image models is surrounded by vectors. The vectors (and thus the surfaces) are preferably defined in Cartesian co-ordinates and mathematics. One of the image models CB could have the same surface sizes or be smaller than the other image model CA. The shapes and/or the

25

colours of different surfaces of the image models, or even designs on them, could be the same. However, they could also be different. The size, shape, colour could be specified in real positive or negative numbers. The angle of rotation and the scale of orientation are preferably specified in radians.

5

- 1b Define lighting conditions, for example both natural or artificial ones that include direct or indirect lighting, whether point or distant with different colour and intensity and positioning of the object along the x-, y-, and z-axis in the digital or virtual or cyber space. Examples are skylight, colored lights, direct or indirect lighting 12, 13 for the image models CA and CB.

10

Step 1a may precede step 1b.

- ii Ensure that each of the defined image models CA, CB are contained or enclosed within each other in a concentric manner and space. Thus, they have a defined "common point" (or common points as described above) CP around which they could be moved. This common point CP could be the origin of co-ordinates in the Cartesian co-ordinate system in which the image models are created. Thus, the image models in the co-ordinate system are united to be a united object. The image models CA, CB could then be rotated in different directions around the common point CP. When both the image models are 3D image models and have the same shape, each of the defined faces of one of the image models should be parallel to each of the corresponding faces of the other image model, at least when originally defined at any one instance.

15

20

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- iii This is provided by either varying any two of the angles of rotation in exactly the opposite directions or by varying at least one of the four values of the scale of orientation.
- 5 iv Code the specification stated in the preceding steps in VRML.
- v Save the coding in step iv in VRML type of file extension.
- 10 vi Retrieve and open the file stored in step v in a Web and VRML enabled Browser.
- 15 vii Ensure that the two image models CA, CB of the united object are seen as one united object in the Web Browser, one of the image models CA or CB being contained and enclosed within the other and both locked to the common point CP, otherwise go to step iv and check the source code.
- 20 viii Use a pointing device, for example a mouse, to make any movement, in any direction (anywhere in the Web Browser) to view the defined and united three dimensional object CA and CB and move the image models around the common point CP.

THE COMPUTER FOR CREATION

25 The invention is implemented on a computer having a processor P, an operating system OP, a HTTP-compliant protocol HC, and a display D, and being connected to a network having a VRML enabled Browser VB. A user can display and view a text or a graphic file, listen to an audio file, or view a file, using this Web Browser VB. Further to this, when a document or a file is coded

and stored as an ASCII text based VRML file using the Cartesian co-ordinate system and mathematics for VRML, the file can be retrieved and viewed in the same Web Browser, or in a native VRML Browser.

- 5 The computer could just be any kind of computer, such as a stand alone desktop, waptop, portable or hand held or digital devices. It could also be a host computer assembled by self, or constructed and manufactured by vendors with any type of BIOS, motherboard with a single or multiple chip sets and processors with any amount of base, extended, cache and virtual memory and RAM.

10

As usual, the user or the Internet or an intranet user needs a logon ID and password either via direct access or via Telnet, FTP, Gopher, or any of the acceptable Internet protocol with any Domain Name to be activated or registered with fixed or dynamically assigned IP addresses from any or all of the Internet

15 classes authorised source.

20

It is also possible to provide a particular password for making it able to download the united object to the user's own storage device or to any other storage devices. Users without this particular password are then only able to look at the united object as it is illustrated in the network. The terms and/or conditions could also be included for use of a copyrighted work in a copyright management information if the united object is downloaded from a server to a client from the Web page or site.

25

CREATING THE IMAGE MODELS

The image models could be created in WRL file (to be further described below) type from coding in a text editor whether it is, single-line or full screen, or

conversion from any known 3D modelling tool, with or without any scripting tools, in any shape, size, and orientation in black-and-white, greyscale, and digital colour palette.

- 5 Basically 3D image models are made up of surfaces. Hence there is a need to cover the following combinations:

	image model CA	image model CB
i	3D	3D
10 ii	3D	2D
iii	2D	3D
iv	2D	2D

Each of the cases above is qualified:

15

	size	shape	colour	Remarks	<u>Notation</u>
	0	0	0	x	0 = different
*ii	0	0	1	minimum effect	1 = same
	0	1	0	1	x = not possible meaning:
20	0	1	1	1	<u>no</u> design can be generated
	1	0	0	1	
	0	0	1	1	
*i	1	1	0	maximum effect	
	1	1	1	x	

25

Notes:

*i represents the most beautiful and infinite design and patterns

*ii represents the design and patterns generated are at its lowest effect. It cannot be qualified as infinite.

Whatever the case may be, the underlying logic is:

- 5 Each of all the surfaces are parallel to the corresponding surfaces, such that two image models are seen as one object.

The image models of the united object CA, CB could be stored in any kind of storage devices, for example single or multiple magnetic ROM, PROM,
10 EAROM or on different kinds of diskettes or CD-RW, CD-R and CD-ROM. It could also be provided on a hard disk, even a removable one.

More than two image models of 3D objects could be provided having the same or different size or colour, and same shape, point, co-ordinate index specified in
15 real positive or negative numbers, angle of rotation specified in radians, and scale of orientation specified in radians. A great variety of art can be generated by keeping the above specification for another different set of input for defining size, shape, colour, point, co-ordinate index.

20 The method according to the invention for 3D object specification is valid and applicable as long as each of the 3D objects so specified are contained or enclosed within each other in a concentric manner. The surfaces of the first image model of 3D object interact with the corresponding parallel surfaces of the second image model of 3D object.

25

In a conventional way, a 3D model to be used according to the invention could initially be hand drawn, moulded, fabricated, or cast by known mechanical means of apparatus. It could also be created by any known mechanical device or

apparatus or any known 3D modelling tool or scanner connected to the computer.

5 The information defining a 3D object at a static position need be modified in order to create new designs and patterns. The information about a 3D object, when it is initially defined, does not permit instantaneous manifestation and display of a new set of concurrent design formation and pattern changes. Thus, changes, such as movements and motion on all surfaces of the defined object, could not be done while it is being anchored at a given position based on its
10 initial object definition. Also, it does not manifest an instantaneous formation of a new set of visible design and pattern changes, movements and motions on all surfaces of the defined object when triggered or activated by a micron-size movement by a given pointing device, for example a mouse, pointing on any of the defined surfaces of the 3D object on the computer screen, just when it has
15 been defined.

A 3D image model is commonly defined by any combination and permutation of primitive geometry shapes, such as cube, cylinder, cone, sphere and torus, including helix and spirals.

20

THE UNITED OBJECT

With this specification according to the invention, it is possible to enclose or contain, lock or interlock at least two 3D image models having the same
25 geometrical dimensions in size in a single united image object of digital space.

According to a preferred embodiment of the invention a VR Art is created and obtained by two defined 3D image models having the same size, shape, colour.

point, co-ordinate index specified in real positive or negative numbers and united into a 3D object. The united image object comprising the image models rotating around the common point CP and provided on the Web can be moved either by varying any two of the angles of rotation in exactly the opposite
5 directions. This means changing positive values to negative values or vice versa, or by varying at least one of the four values of the scale of orientation. Pointing at the united object will activate one or the other of these alternatives.

When a defined united 3D object, such as the one shown in FIG 3, is placed on
10 the VRML enabled Web Browser, it is seen on the screen as a single united 3D object. The initial position of this object could be called Entry View. Under the same anchoring or pivoting position of the united object the viewer can slide or walk, pull, push, rotate or roll, spin or turn, examine and/or point at the object within the Web space using the pointing device, which will be further discussed
15 below.

By doing so, a great variety of patterns are instantaneously generated on every single face of the object simultaneously. In addition, the united object displays a new set of visible design and pattern changes, movements and motion on all
20 faces of the defined united object, even at a micron-size movement, triggered or activated by a pointing device of the kind mentioned above on any of the defined surfaces of the united 3D object on the screen, or some other viewing device. The continuous movements of this VR Art can be interrupted, directional changes activated, if desired, and resumed at any time during any
25 session at the Web page.

When the 3D object has been placed in a Web-enabling Browser, it is made interactive. Alternatively, when a VRML file is imported into a 3D modelling

tool, it is automatically made interactive, i.e. able to be manipulated by a given pointing device. Interactive Web enabled art can also be an assembly of a defined sequence of a series of hand drawn pictures or bitmap formatted or vector graphic files. These are first created by a two dimensional graphic editor, then played in succession or generated by a series of graphics formed by a 2D animation tool.

Since the VR Art product or method according to the invention is an ASCII text based mathematically defined creation it maintains a constant resolution regardless of the graphic sampling size, resolution, and display technologies of the device used. It can thus be reached by all HTTP-compliant VRML enabled Browser ranging from a computer system to a WAP-compliant mobile phone screen.

The VRML file created in the way mentioned above can be a part of, or a linked current generation of, any Hypertext Markup Language with file extension, such as HTML, HTM, SHTML, SHTM, DHTML, <framed> or <unframed>, embedded or non-embedded with any Scripting Language, according to the hypertext coding conversion, as well as XML or WML. The VRML file can be activated in response from an activation of a link from a Web page with or without TCP/IP connection.

SHAPES

The shapes could be combinations of primitive geometry shapes, such as cubes, cylinders, spheres and toruses, including helixes and spirals, text editor and/or any of their derivatives.

Each 3D image model CA, CB in a united object could comprise of text and/or any of the shapes and/or any of their derivatives by means of addition, subtraction, union or join or any Boolean operations between two or more geometrical shapes with similar or dissimilar material properties under any lighting conditions and be placed in a given environment. Each defined image model can be deformed, transformed, or nurbed (NURB = Non-Uniform Recursible B-Splines, i.e. to make the intersection of edges of a 3D object non-angulated (or to make smooth surfaces) polyhedrons), by any mechanical means or 3D modelling tools. The defined united object provided according to the invention can be viewed from any viewing angle at a given location at a given time.

VIEWING DEVICE

15

The viewing device could be any kind of monitor display, such as CRT, LCD or plasma screen display of any size. It could also be a projector screen or the like.

20

The viewing device could have any refresh rate, colour palettes configured to any number of pixels using display technologies assembled by self, or manufactured by any known OEM having any graphic adapter card and any VRAM capacity with or without graphic accelerator card. The viewing device could be connectable to for example a standalone desktop, Waptop, portable computer or handheld device, or a host computer connected to a wired or wireless network.

25

The viewing device could also be connected to at least one projector or projector system in accordance with any display technologies, to which the computer

could be connected. The projector and projector system could be provided with embedded PC cards, DLP with any resolution, brightness, lamp type, lamp life, lens type, contrast ratio, aspect ratio. The projector and projector system could be placed at a distance from the computer and be adapted to any image size, operating with any power supply with any number of RGB input source.

VRML

A set of VRML commands is represented by keywords and mathematical co-ordinates. This set defines vertices, lines, surfaces of a 3D image model in order to determine the geometry of the image model in term of its structure. This means in terms of its shape and size, its colours in hues and shades, material properties, lighting 12, 13, both natural or artificial including direct or indirect lighting. The lighting could be point and/or distant with different colours and intensities, and with different positioning in relation to the object expressed in the Cartesian co-ordinates x, y and z. This could be in digital or virtual form or in the cyberspace.

The keywords facilitate the defined object to scale, rotate, translate and transform the geometry therein. VRML could be coded in ASCII text. VRML may instead be generated by some commercially available 3D modelling tool or conversion utility. VRML keywords are case sensitive. A VRML command can be preceded or followed by any number of blank spaces between statements and lines. A VRML file may include or exclude comment statements.

Importing files can be used in conjunction with VRML commands, such as translate, Position Interpolator with key and key values, Orientation Interpolator with key and key values, as well as specifying a Time Sensor, clock interval

with changeable clock fraction Scale.set_fraction, Pos.set_fraction and Rotate.set_fraction. Any of these commands can be repeated depending on the number of 3D objects defined by that VRML file.

5 NATIVE WRL CODING

The WRL file type can be created from coding in a text editor, single-line or full-screen or conversion from any known downloadable and/or commercially available 3D modelling tools with or without any scripting tools and vice versa
10 in any shape, size, form and orientation in black-and-white, greyscale and digital colour palette on any hardware and operating system.

The method of defining and storing in a file format defined as a native WRL file extension or its equivalent in a file format in one of the following languages
15 HTM or HTML, SHTML, C-HTML, WML, or XML, or any of the existing markup languages, in any of their combinations, with or without any scripting languages, like Javascript, scriptlets, applets, servlets, JavaServer Page, Perl Script, tcl/tk, <framed> or <unframed>, with or without password protection, or any other permissible file format in a compressed or non-compressed form for
20 any Internet or Intranet supported operating system or ubiquitous platforms like Java.

- any of the genre of a markup language, regardless of the specified definition of this markup language file extension and its file name is in upper or lower
25 case or a combination of upper and lower case, thus permitting storage, execution, and retrieval of such file.
- any of the genre of the markup language can be coded with enclosing any number of intervening blank spaces, as in “ ”, and/or “#160;” between any of

the markup language tags according to the respective markup language specifications.

- VRML is case sensitive, as specified in the VRML definition.

5 THE CODING IN ASCII

The specified method of coding in ASCII text herein contained in a VRML file can be imported into a 3D modelling tool or software. A solid or transparent model could be used with or without a solid outline rendered or unrendered.

- 10 Each surface of the model could be provided with a wire frame with or without scene graphs or backgrounds. It could be provided on an operating system or platform of a computer system or portable computer, or be provided on a hand held device. The representation of the united 3D object created as imported VRML file seen outside a Browser is illustrated in FIGs 8 and 9.

15

While importing files, the method of coding in ASCII text based VRML can also be converted in some way known per se. For example, it could be browsed in a Java enabled Browser with or without parameter input values, to be viewed on- or off-line, or it could be converted by some means of 3D model conversion

20 for browsing and usage in the Worlds.

The coding in ASCII text based VRML file can also be used in conjunction with audio and image files contained in the same VRML source code file. The coding can be repeated with different sets of input values contained in a single VRML

25 source file.

The specific method of coding an ASCII text based VRML file stated in the invention can be exported to create current and/or future versions and releases of

movie file formats including the genre of files denoted by Quick Time, Flash, Director and AVI file formats and the like, MPEG file formats, animated GIF file formats, animated sequences in a variety to bitmap or vector graphics file formats. All files can be either compressed or uncompressed files having any
5 resolution, colour and size.

The specific method of coding an ASCII text based VRML file in accordance with the invention can be exported and/or converted to create the current and future versions and releases of screen savers. It can be saved as current or future
10 versions and releases of "Desktop wallpaper". It may also be used by pressing "PrintScreen" with or without combinations of other keystrokes, such as "Alt" or "Ctrl" for static Screen Capture. Further to this, it can also be saved as current or future versions and releases of screen capture denoted by 'scn' type of file formats for example. All the files can then be displayed and stored in either
15 compressed or uncompressed files with any resolution, colour and size.

The specific method of coding an ASCII text based VRML file in accordance with the invention, when exported to a 3D printing device or robot, can be output into a solid model. When two or more units of such output solid models
20 are available, with further research, it may not be entirely impossible to achieved at least one of the infinite number of design and patterns viewable by some defined mechanical device fabricated in the real world.

25 THE NETWORK

The network could be a local area network (such as an intranet), a wide area network (such as Internet). It could be any kind of network type having any kind

of configuration, adapter cards and protocol activated and viewed within a World Wide Web HTTP-compliant protocol enabled Browser with or without server connections over TCP/IP connected to a dial-up or cable modem or the like, or a leased line, or over ISDN, ADSL, ASLP, E1, T1, T3, AT&T Globe Span, Nortel Internet Throughway, ATM, wireless gateway, or via PCMCIA technologies.

POINTING DEVICE

10

As pointing device bringing the united object to be moved, the following devices could be used:

an accu-point, a track-ball, a touch-pad, a one-, two- or three-button wired or wireless programmable or non-programmable mechanical or optical mouse.

15

The pointing devices could react on any movement from a micron-size onwards and/or include any arrow-key on a wired or wireless computer keyboard, a numeric key-pad, foot-pedal, or other kind of steering devices to control the speed like start, stop and/or move the 3D object in any direction, orientation, with any magnification, size, resolution, colour and colour palette.

20

The notation of the specified method of coding in ASCII text based VRML files according to the invention, stating the method as containing and enclosing at least two image models of 3D objects within each other in a concentric space, having each of the defined faces of a image model parallel to the corresponding face of all the rest of the other 3D image models at any instance can be extended to creating a united 3D object using a hand held 3D wire frame creation pointing device. This device can be connected to a portable or non-portable computer

25

system and a black-box styled hardware device with a set of built-in software programs to structure and render wire frame design on screen.

5 The interaction with the united object provided in a browser in the network could be provided with a pointing device including an accu-point, a track-ball, touch-pad, one- two- or three-button wired or wireless, programmable or non-programmable mechanical or optical mouse. The pointing device could be placed anywhere in the browser. Any kind of steering mechanism could be provided in order to control the united object to be moved in any direction, size,
10 resolution, and colour and colour palette with any chosen speed.

AUDIO INFORMATION

15 The displayed united 3D object within a browser in the network, such as Internet or an intranet, could be provided with audio accompaniments. The accompaniments could for example comprise a voice information, poems and/or any other genre of literary works. The works could be recorded, live, or simulated performance with any sound and/or voice and/or music with any conventional analogue or digital techniques connected or not connected to any
20 number of projectors.

IMAGES ON THE SURFACES OF THE IMAGE MODELS

25 The surfaces of the image models in a united object could be provided with the same or different pictures, which could be still or moving. Moving pictures could for example show human or animal movements including crawling, walking, running, aerobics and any form of dance movements. It could also be

scenes from the nature or the like. All these can be representated figuratively or in abstract format.

Audio accompaniments to moving pictures could provide really vivid and/or beautiful views for the viewer and can definitely draw the attention to a Web Page or Site. Advertising messages could be enhanced by using the kind of informative products according to the invention.

STORAGE DEVICES

Storage can be provided in a single or multiple magnetic read-only, read and write, read and removable or non-removable storage device and medium, such as a 5 ¼ " 1.44 MB diskette, or a 3.5" 1.44 MB or 2.88 MB or 128 MB diskette, or a CD-RW or CD-R or a hard disk internal or external to a computer system unit connected, un-connected, or disconnected to all types of server, or disk arrays or optical devices with any storage capacity that can accommodate the format mentioned above.

The computer system could also comprise of a cache memory, to which any downloadable cache copy from a Web page or a Web Site could be temporarily stored. The copyright management information then includes the terms and conditions for use of a copyrighted work being downloaded from the server to the client from the Web page or Site. This information further includes the execution of webcopy, web-crawling, meta-web-crawling, Web Spiders.

Scooters using any robot.txt-compliant protocol and/or redistribution via any electronic transmission by an Internet user.

PRINTING

The source of the VRML file with the specified method of coding an ASCII text based VRML file stated in accordance with the invention, and the creation
5 generated by this source file can be printed using almost all of the existing and/or future generations of standalone or networked two dimensional black and white and/or colour printer on- or off-line with different image resolution, colour management, print quality on different paper size with different textures.

10 EXAMPLES

By extending the inventive method various design and patterns can be created, as shown in the FIGs 12 and 13.

15 RECORDING OF THE VR ART

The VR Art according to the invention could be recorded on any surface type by any digital or non-digital recording and playback devices including any genre of digital photo, video or Web cameras on- or off-line with any recording media in
20 true RGB (Red, Green, Blue) or CMYK (Cyan, Magenta, Yellow, Black) or grayscale or Black and White rendition in any resolution.

The file extension of the VRML file, as shown in FIG 4, used to generate the VR Art:

25 The VR Art as shown in the FIGs 5 to 9 and all its infinite number of variations created using the method according to the invention can be saved in the file extension WRL and any of its future derivations. Since file extensions are case

sensitive, this means that all combinations of upper and lower case, that permit execution of the VRML file herein, are considered as acceptable and identical.

The VR Art can be browsed in all HTTP-compliant VRML enabled browser,
5 such as the one shown in FIG 4 with or without connection via TCP/IP under a great majority of existing known operating systems and platforms.

The VR Art can also be browsed in a native VRML-enabled browser.

10 The invention would be useful to create and provide access to VR Art and building a Sculpture Park on and off the Web with or without TCP/IP connection, or export to or converting the VRML source file into a file format suitable for use of file creation in a 3D modelling tool of software or Java Applets of any intelligent pointing device, or output to any 2D or 3D printers,
15 from any computer system to a HTTP-compliant protocol VRML enabled browser to a WAP-compliant mobile phone display screen. All such variations of this type of art are considered within the scope of the invention as defined by the accompanying claims regardless of whether the display is to be viewed on any genre of a display screen or from a projection screen or a printable surface, or
20 eventually fabricated as a solid model in the real world space.

We claim

1. A computer program product for operating a general-purpose computer system connected to an Internet or an intranet and comprising a display unit, an input unit, a storage unit, an output unit, a control unit, and a processing unit for VR (Virtual Reality) Art, **characterized** by providing an image on a Web page, the computer program product comprising of:

- VRML (Virtual Reality) code, which when run on a computer connected to a display causes the computer to generate at least a first image model (CA);
- VRML code, which when run on the computer connected to the display causes the computer to generate at least a second image model;
- VRML code, which when run on the computer connected to the display causes the computer to move the first image model in relation to the second image model, and/or vice versa, both around a common point (CP) such that the first and second image models are mutually movable and rotational with respect to said common point (CP) and thus are united to be seen as one image object at anytime;
- the first and second image models being created in Cartesian co-ordinates and their respective rotation being specified in radians.

2. A computer program product according to claim 1, **characterized** in that the VRML codes for said first and second image models are provided in an ASCII text based VRML.

3. A computer program product according to claim 1 or 2, **characterized** in that each of the image models are either a 2D or a 3D image model, the united image object comprising of the first and second images movable around the common

point (CP) has one of the following combinations: two 3D images, two 2D images, and one 2D and one 3D image.

4. A computer program product according to anyone of the preceding claims,

5 **characterized** in that

the image models are placed in a Web browser in the Internet or an intranet and are united as the image object to be shown on the display unit;

the image models are then able to be moved arbitrarily by means of the control unit operated by an user at a computer with a VRML-enabled Web browser.

10

5. A computer program product according to anyone of the preceding claims, **characterized** in that the image models (CA,CB) united in an image object are different in relation to each other regarding at least one of following features: size, shape, colour.

15

6. A computer program product according to anyone of the preceding claims, **characterized** in that

if both the image models in a said united image object are 2D or 3D objects, the computer program product is adapted to provide the unit models in a concentric manner in relation to each other united at the common point (CP).

20

7. A computer program product according to anyone of the preceding claims, **characterized** in that

if one of the image models in said united image object is 3D and the other 2D,

25

the computer program product is adapted to provide the 2D object in relation to at least one surface of the 3D unit of the object united at the common point.

8. A computer program product according to anyone of the preceding claims, **characterized** in that

the computer program product is adapted to control, by means of the controlling device, the display of the united object provided on a Web Browser to move the
5 united object with a controlled speed to be viewed in a selected orientation, resolution and/or dimension continuously or randomly.

9. A computer program product according to claim 8, **characterized** in that the computer program product is adapted to create WRL file type from coding in
10 a text editor, single-line, full screen, or conversion from any known 3D modelling tool, with or without any scripting tools, in any shape, size, and orientation in black-and-white, greyscale, and digital colour palette.

10. A computer program product according to anyone of the preceding claims,
15 **characterized** in that:
the computer program product is adapted to store the defined image models in a file format defined as a native WRL file extension, or an equivalent of it, contained, but not limited to, in an existing genre and/or future versions and releases of a markup language file format such as HTML.

20

11. A computer program product according to anyone of the preceding claims, **characterized** in that:
the computer program product is adapted be contained in any of the genre of a markup language, regardless of whether the specified definition of this markup
25 language file extension and its file name is in upper case or lower case, or a combination of upper and lower case, thus permitting the storage, execution and/or retrieval of this file extension.

12. A computer program product according to anyone of the preceding claims, **characterized** in that:

the computer program product is adapted to enclose any number of intervening blank spaces, as in " ", and/or " " between any of the markup language tags in any font types, font size and/or font colour.

13. A computer program product according to anyone of the preceding claims, **characterized** in that the computer program product is adapted to

include any simultaneously downloadable cache copy from a Web page or a Web site from a direct or indirect link to be included in a presentation software provided on a Web page or Web site in the Internet or an intranet; includes the terms and/or conditions for use of a copyrighted work in a copyright management information if the united object is downloaded from a server to a client from the Web page or site.

14. A computer program product according to anyone of the preceding claims, **characterized** in that

the computer program product is adapted to provide any user with any logon ID and/or password via direct access or any acceptable Internet protocol with any Domain Name with fixed or dynamically assigned IP addresses.

15. A method in a computer system comprising of a client computer (5) and a server computer (1) the said client computer (5) being connectable to the said server computer (1) via a network (4), such as the Internet or an intranet, for enabling the down loading of a complex image in a time efficient manner using a limited bandwidth, the method comprising of the steps:

- addressing a Web page provided by the server computer (1) or client computer (5);

- downloading a computer program file according to anyone of the preceding claims.

16. A method for operating a general-purpose computer system connected to the Internet or an intranet and comprising a display unit, an input unit, a storage unit, an output unit, a control unit and a processing unit for VR (Virtual Reality) Art, **characterized by**

- defining at least one first image model (CA) of a first two or three dimensional object in a co-ordinate system and mathematics in an ASCII text based VRML;
- defining at least one second image model (CB) of a second two or three dimensional object having the same or smaller size than the first object in a co-ordinate system and mathematics in an ASCII text based VRML;
- the image models (CA,CB) being specified in real positive or negative numbers, angle of rotation, and scale of orientation;
- providing the image models in a VRML enabled Web Browser;
- uniting at least first and the second image models into a united image object in relation to a common point (CP).

17. A method according to claim 16, **characterized by:**
varying both the image models (CA,CB) in the united object either any two of the angle of rotation in exactly the opposite directions, or by varying at least one of four values of the scale of orientation with at least one plane or one surface of one of the image models having the same angle of rotation as the corresponding plane or surface of the other image models.

18. A method according to claim 16 or 17, **characterized** in that, if both the image models in a said united image object are 2D or 3D objects, providing the

unit models are placed in a concentric manner in relation to each other united at the common point (CP).

19. A method according to claim 16, **characterized** in that, if one of the image
5 models in said united image object is 3D and the other 2D, providing the 2D
object in relation to at least one surface of the 3D is object united at the common
point.

20. A method according to anyone of the claims 16 to 19, **characterized** by
10 controlling the display of the 3D united image object provided on a Web
Browser to provide a selected or desired view of the united image object.

21. A method according to anyone of the claims 16 to 20, **characterized** by
controlling, by means of a control means, the display of the united object
15 provided on a Web Browser to move the united object with a controlled speed to
be viewed in a selected orientation, resolution and/or dimension.

22. A method according to anyone of the claims 16 to 21, **characterized** by
creating WRL file type from coding in a text editor, single-line, full screen, or
20 conversion from any known 3D modelling tool, with or without any scripting
tools, in any shape, size, and orientation in black-and-white, greyscale, and
digital colour palette.

23. A method according to anyone of the claims 16 to 22, **characterized** by
25 storing the defined image models in a file format defined as a native WRL file
extension, or an equivalent of it, contained, but not limited to, in an existing
and/or future versions and releases of a markup language file format such as
HTML.

24. A method according to claim 23, **characterized** by storing the defined united image object to be contained in any of the genre of a markup language, regardless of the specified definition of this markup language file extension and its file name is in upper case or lower case or a combination of upper and lower case, thus permitting the storage, execution and/or retrieval of such file.

25. A method according to claim 23 or 24, **characterized** by enclosing any number of intervening blank spaces, as in " ", and/or " " between any of the markup language tags in any font types, font size and/or font colour.

26. A method according to anyone of the claims 23 to 25, **characterized** by including any simultaneously downloadable cache copy from a Web page or a Web site from a direct or indirect link to be included in a presentation software provided on a Web page or Web site in the Internet or an intranet; including the terms and/or conditions for use of a copyrighted work in a copyright management information if the united object is downloaded from a server to a client from the Web page or site.

27. A method according to claim 26, **characterized** by providing any user viewing of the united object with any logon ID and/or password via direct access or any acceptable Internet protocol with any Domain Name with fixed or dynamically assigned IP addresses.

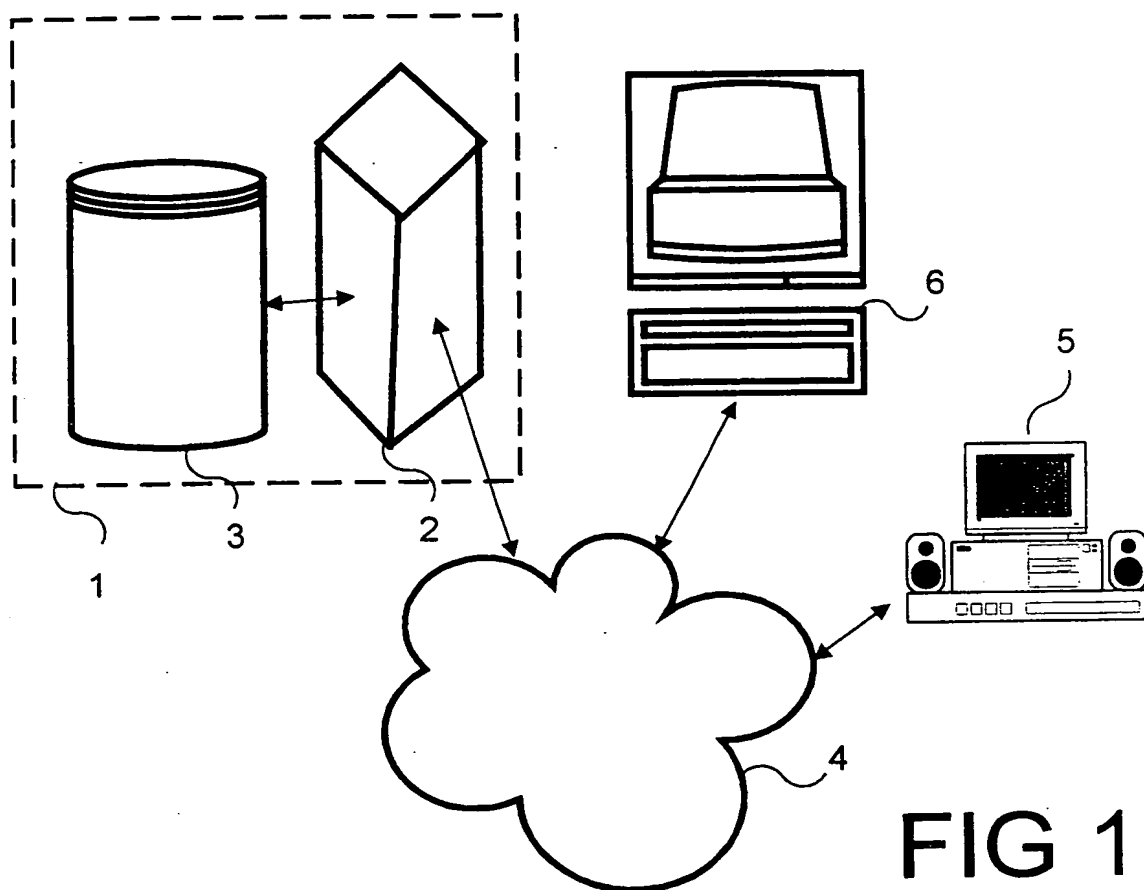


FIG 1

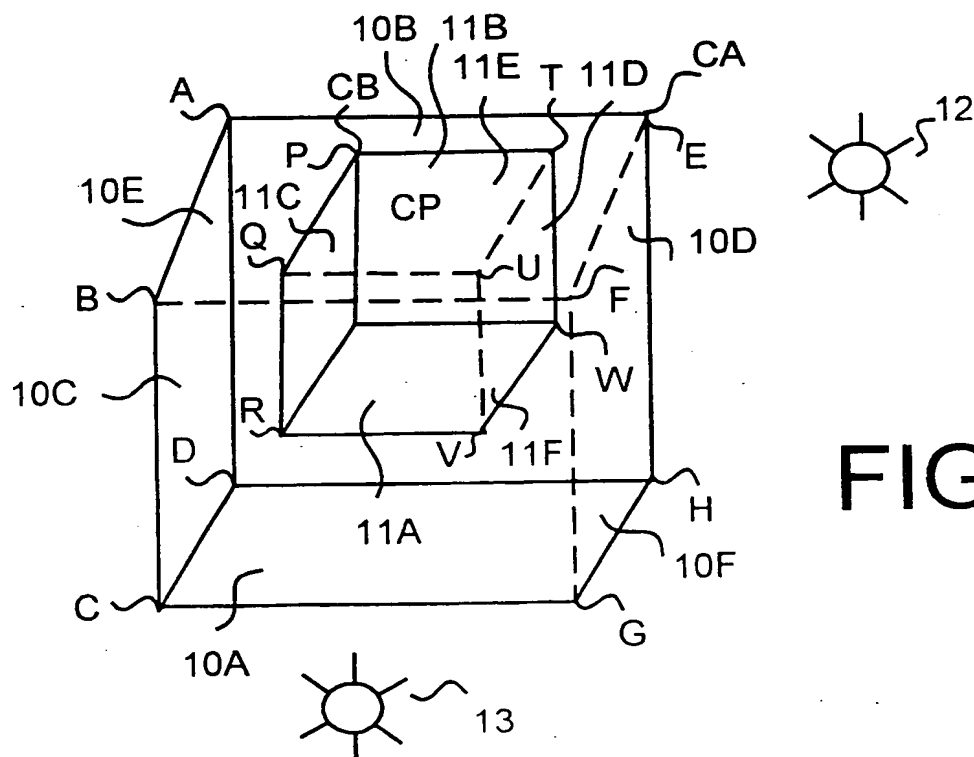
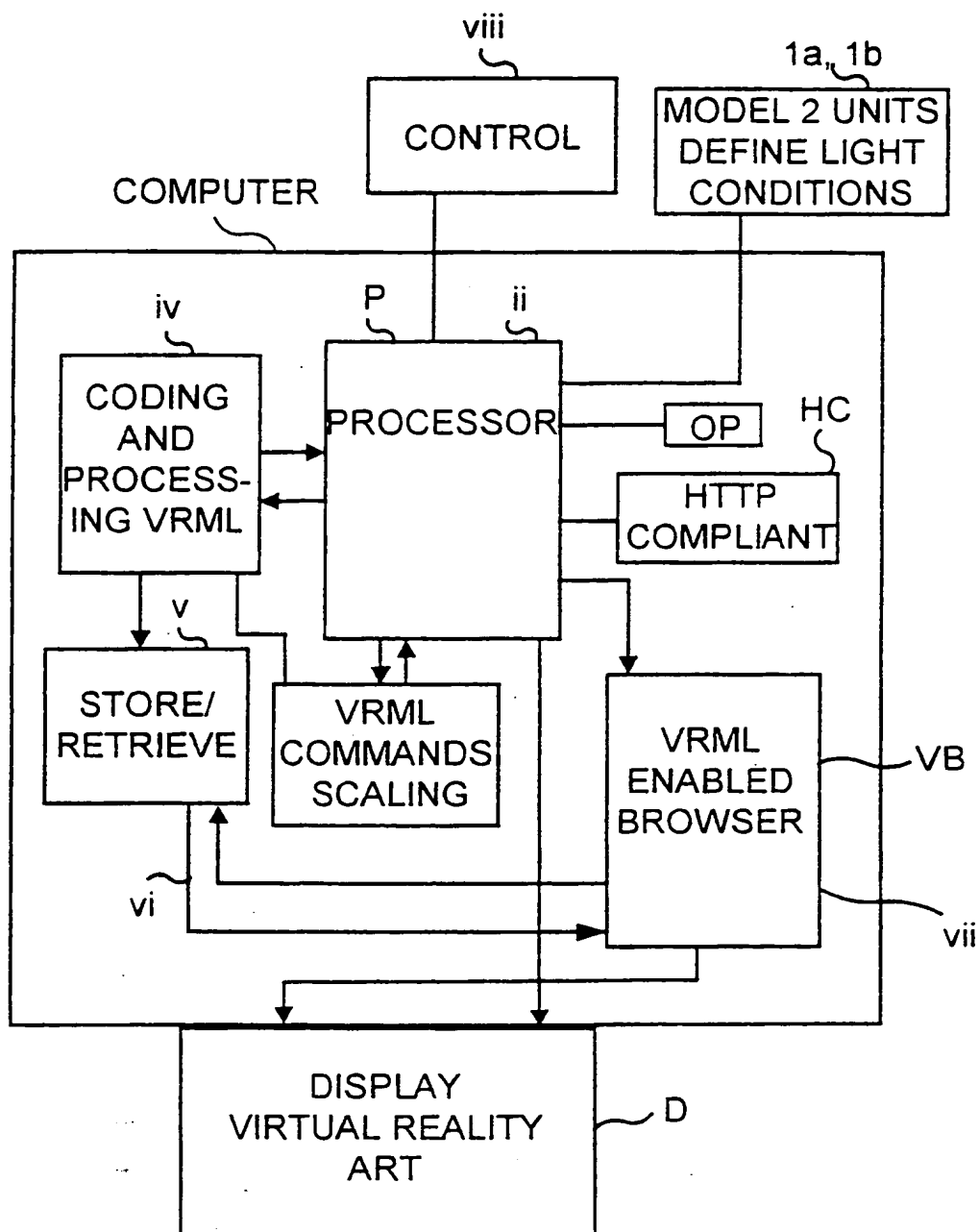


FIG 3

**FIG 2**

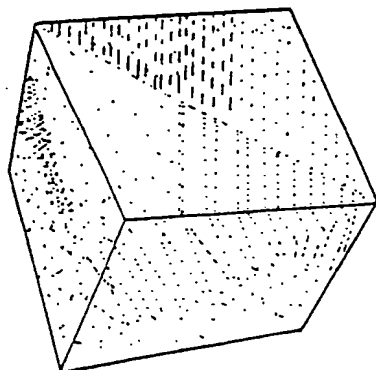


FIG. 6

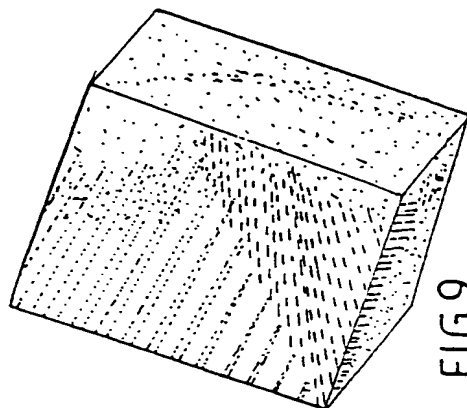


FIG. 9

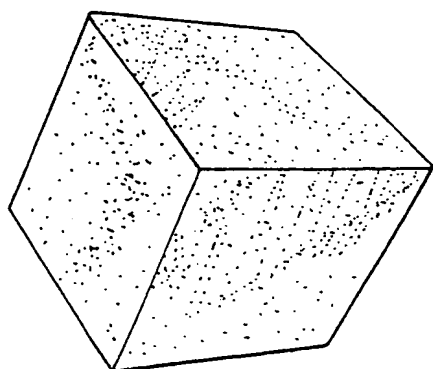


FIG. 5

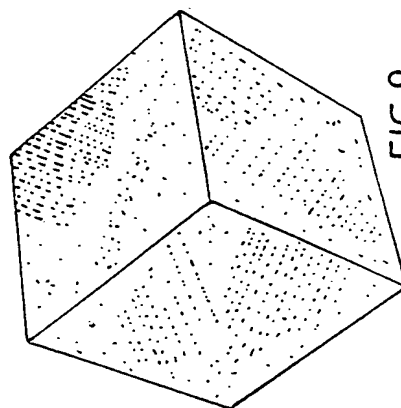


FIG. 8

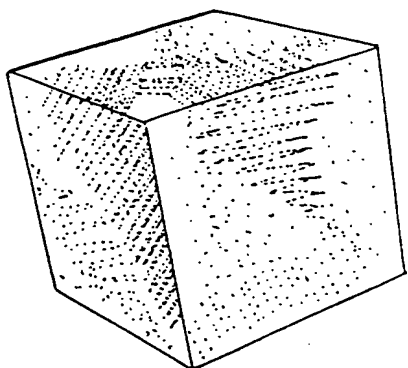


FIG. 4

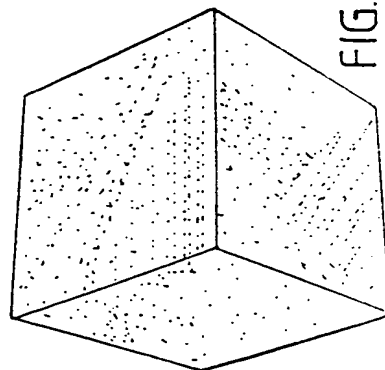


FIG. 7

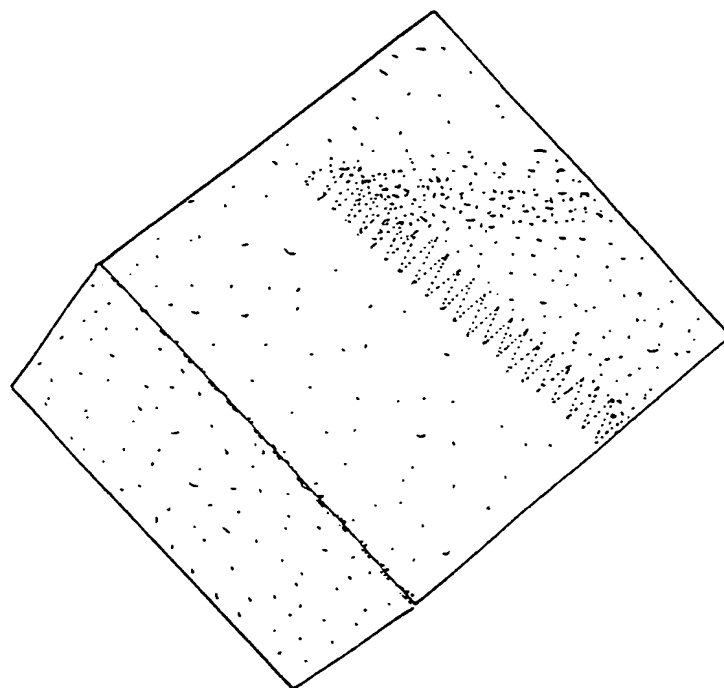


FIG. 11

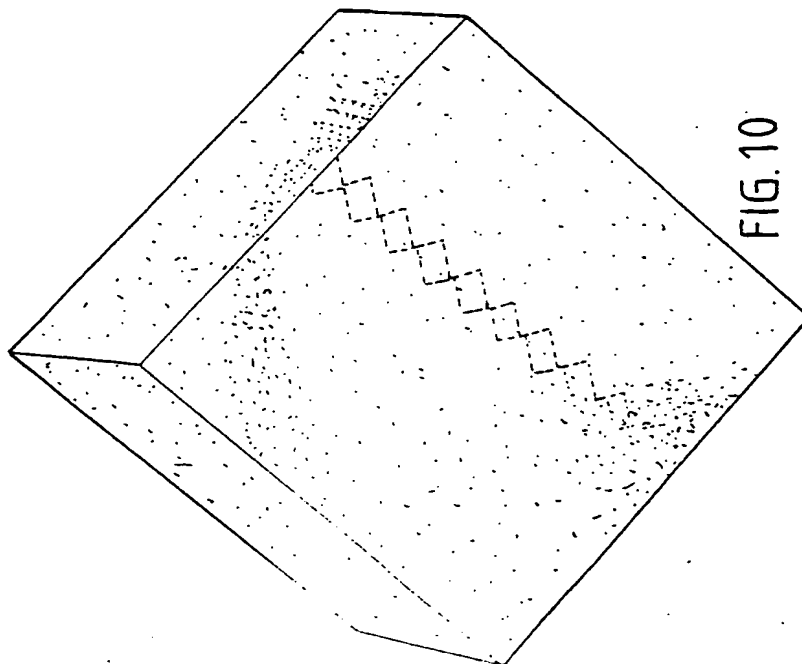


FIG. 10

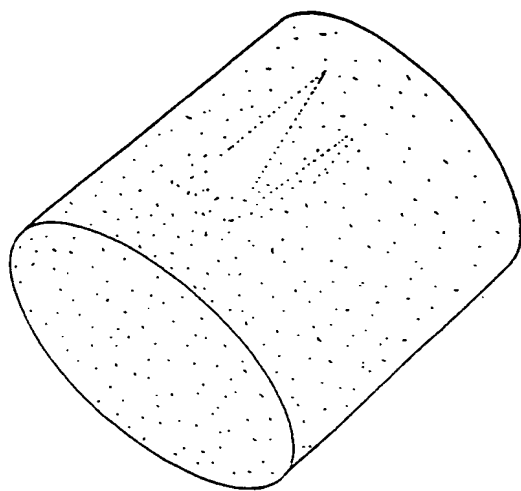


FIG. 13

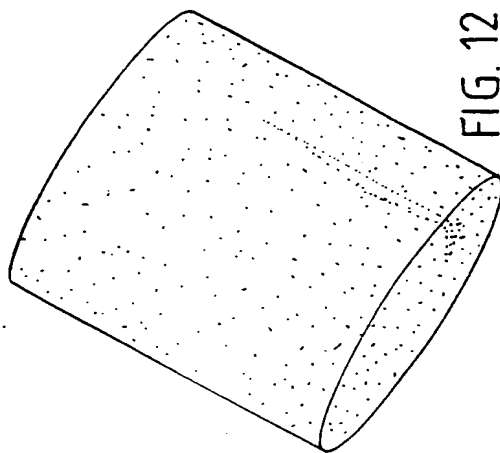


FIG. 12

INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB 00/01599

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G06T15/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G06T

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, INSPEC, PAJ, IBM-TDB

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 753 834 A (SONY CORP) 15 January 1997 (1997-01-15) abstract; claims 1-8; figures 5,9,16,22,29 column 27, line 11 -column 35, line 5 ---	1-27
X	EP 0 926 591 A (CASIO COMPUTER CO LTD) 30 June 1999 (1999-06-30) abstract; claims 1-16; figures 14,25,29 ---	1-27
A	US 5 956 028 A (KAWAGUCHI NAOHISA ET AL) 21 September 1999 (1999-09-21) the whole document ---	1-27
A	EP 0 899 695 A (SONY CORP) 3 March 1999 (1999-03-03) the whole document -----	1-27

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

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- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *S* document member of the same patent family

Date of the actual completion of the international search

13 March 2001

Date of mailing of the international search report

22/03/2001

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/IB 00/01599

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